

1     **CLAIMS**

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3     1.    A body protecting device for wearing by a user  
4     comprising an array of energy absorbing cells,

5           wherein each cell comprises a tube,

6           and wherein substantially each tube has a side  
7     wall which is near or adjacent to the side wall of  
8     at least another tube,

9           and wherein substantially each tube is  
10    configured such that the orientation of the tube is  
11    substantially maintained when a load is applied  
12    parallel to the axis of the tube.

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14    2.    A body protecting device as claimed in Claim 1,  
15    wherein the tube has a cylindrical or conical  
16    structure.

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18    3.    A body protecting device as claimed in Claim 1  
19    or 2, wherein the body protecting device comprises a  
20    safety helmet.

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22    4.    A body protecting device as claimed in any  
23    preceding claim, wherein substantially each tube has  
24    a side wall which abuts the side wall of at least  
25    another tube.

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27    5.    A body protecting device as claimed in any  
28    preceding claim, wherein substantially each tube has  
29    a side wall which is connected to the side wall of  
30    at least another tube.

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1     6.    A body protecting device as claimed in Claim 5,  
2     wherein substantially each tube has a side wall  
3     which is connected to the side wall of at least  
4     another tube by an adhesive.

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6     7.    A body protecting device as claimed in Claim 5  
7     or 6, wherein substantially each tube has a side  
8     wall which is connected to the side wall of at least  
9     another tube substantially along the length of the  
10    tube.

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12    8.    A body protecting device as claimed in Claim 5,  
13    wherein substantially each tube has a side wall  
14    which is welded or fused to the side wall of at  
15    least another tube.

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17    9.    A body protecting device as claimed in Claim 8,  
18    wherein one or more tubes are formed from an inner  
19    core comprising a first material and an outer core  
20    comprising a second material.

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22    10.   A body protecting device as claimed in Claim 9,  
23    wherein the second material has a lower melting  
24    temperature than the first material.

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26    11.   A body protecting device as claimed in any  
27    preceding claim, wherein substantially each tube is  
28    near or adjacent to at least three other tubes.

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30    12.   A body protecting device as claimed in any  
31    preceding claim, wherein substantially each tube is  
32    near or adjacent to six other tubes.

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2 13. A body protecting device as claimed in any  
3 preceding claim, wherein each tube has a diameter of  
4 between 2 and 8 mm.

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6 14. A body protecting device as claimed in any  
7 preceding claim, wherein each tube has a diameter of  
8 about 6 mm.

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10 15. A body protecting device as claimed in any  
11 preceding claim, wherein the thickness of the side  
12 wall of each tube is less than 0.5 mm.

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14 16. A body protecting device as claimed in any  
15 preceding claim, wherein the thickness of the side  
16 wall of each tube is between 0.1 and 0.3 mm.

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18 17. A body protecting device as claimed in any  
19 preceding claim, wherein the length of each tube is  
20 less than 50 mm.

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22 18. A body protecting device as claimed in any  
23 preceding claim, wherein the length of each tube is  
24 between 30 and 40 mm.

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26 19. A body protecting device as claimed in any  
27 preceding claim, wherein the array of energy  
28 absorbing cells is provided as an integral material.

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30 20. A liner for a body protecting device for  
31 wearing by a user, the liner comprising:

1           a first material having an array of energy  
2   absorbing cells, wherein each cell comprises a tube,  
3   and wherein substantially each tube has a side wall  
4   which is near or adjacent to the side wall of at  
5   least another tube, and wherein substantially each  
6   tube is configured such that the orientation of the  
7   tube is substantially maintained when a load is  
8   applied parallel to the axis of the tube.

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10   21. A liner as claimed in Claim 20, wherein the  
11   body protecting device comprises a safety helmet.

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13   22. According to a third aspect of the present  
14   invention, there is provided a body protecting  
15   device comprising:

16           a first material bonded to a second material  
17   using an adhesive, wherein the adhesive has a melt  
18   temperature which is lower than the melt temperature  
19   of the first and second material.

20

21   23. The body protecting device of Claim 22, wherein  
22   the first and second materials are in a softened  
23   state at the melt temperature of the adhesive.

24

25   24. The body protecting device of Claim 22 or 23,  
26   wherein the first material is one of a  
27   polycarbonate, polypropylene, polyetherimide,  
28   polyethersulphone or polyphenylsulphone material.

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30   25. The body protecting device of any of Claims 22  
31   to 24, wherein the second material is a plastics  
32   material.

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2 26. The body protecting device of Claim 25, wherein  
3 the second material is a fibre reinforced plastics  
4 material.

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6 27. The body protecting device of any of Claims 22  
7 to 26, wherein the adhesive is a thermoplastic.

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9 28. The body protecting device of Claim 27, wherein  
10 the adhesive is a polyester based material.

11

12 29. The body protecting device of any of Claims 22  
13 to 28, wherein the melt temperature of the adhesive  
14 is less than 180°C.

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16 30. The body protecting device of Claim 29, wherein  
17 the melt temperature of the adhesive is between  
18 120°C and 140°C.

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20 31. The body protecting device of Claim 30, wherein  
21 the body protecting device is heated during forming  
22 to between 155°C and 160°C.

23

24 32. The body protecting device of any of Claims 22  
25 to 31, further comprising a third material, wherein  
26 the first material interposes the second and third  
27 materials, and wherein the first material is bonded  
28 to the third material using the adhesive.

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30 33. The body protecting device of any of Claims 22  
31 to 32, wherein the first material has an array of  
32 energy absorbing cells, each cell comprising a tube.

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2 34. A method of forming a body protecting device  
3 comprising:

4 bonding a first material to a second material  
5 using an adhesive, wherein the adhesive has a melt  
6 temperature which is lower than the melt temperature  
7 of the first and second material.

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9 35. The method of Claim 34, including selecting  
10 first and second materials which are in a softened  
11 state at the melt temperature of the first material.

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13 36. The method of Claim 34 or 35, including heating  
14 the body protecting device during forming to between  
15 155°C and 160°C.

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17 37. The method of any of Claims 34 to 36, including  
18 bonding the first material to a third material using  
19 the adhesive.

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21 38. The method of any of Claims 34 to 37, wherein  
22 the first material has an array of energy absorbing  
23 cells, each cell comprising a tube.

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